THE EFFECTS OF DELAYING CONSEQUENCES ON THE LEARNING OF EMOTIONALLY DISTURBED CHILDREN

By

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Abstract of Dissertation Presented to the Graduate Council
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THE EFFECTS OF DELAYING CONSEQUENCES ON THE LEARNING OF EMOTIONALLY DISTURBED CHILDREN

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The major purpose of this investigation was to assess the impact of three conditions of delayed consequence as they interacted with two types of feedback on the learning of emotionally disturbed children. The three conditions of delay studied were (a) delays of 10"-45", (b) 15', and (c) 3-hours. The three delay conditions were examined under two types of feedback consequence. The six conditions were applied during a two-week period of time.

The two types of feedback consequence studied were (a) discriminative cue sheets attendant at consequation, and (b) discriminative cue sheets absent at consequation. The discriminative learning task consisted of 48 unique geometric figures which were randomly grouped into 24 pairs. Six sets of four pairs each were randomly assigned to each child participating in the investigation for each of the six conditions. Each discriminative cue sheet contained two geometric figures, the positions of which were randomly assigned. The child's task consisted of learning which of the two geometric figures was correct on each discriminative cue sheet.

The influence of the six conditions on the learning of emotionally disturbed children was studied as it effected the (a) log rates of correct responding, (b) the number of correct responses, (c) response times, and (d) celeration ratios.

Results of the investigation indicated that (a) the presentation of the discriminative cue sheets at consequation enhanced the number of correct responses achieved and conceivably the log rates of correct responding, (b) the various delays (10"-45", 15', and 3-hours) had no differential effects on the learning of emotionally disturbed children participating in the study, and (c) the children responded uniquely to the various combinations of feedback consequence and the three conditions of delay.

CHAPTER I

INTRODUCTION

Techniques of response measurement and reward systems have become inveterate components of special education programs. Growth of programs using an analysis of behavior approach can be partially attributed to the apparent simplicity in applying the techniques.

A variety of procedures have been used to augment or enhance behaviors of students in various settings by employing the principles of response measurement and reward systems (Brady, 1968; Giles & Wolf, 1966; Lovass, 1964; Risley, 1968; Wahler, 1969). These principles have been derived from theoretical and empirical work in the study of the psychology of learning. Of the major techniques, operant conditioning (Kazdin & Craighead, 1973; Krasner & Ullmann, 1965; Ullmann & Krasner, 1965) has been applied far more extensively than classical conditioning in special education programs because behaviors of primary interest to special educators have been operant in nature. It is on the basis of certain specific operant behaviors that children are evaluated and considered for educational alternatives in specialized settings.

Response measurement and reward systems focus on precisely describing behaviors which characterize a child's learning or behavioral problems. Once the stimulus situation and environmental events surrounding a behavior have been identified, the educator seeks to design an environment which will support certain, targeted, adaptive behaviors. Such a plan is generally implemented by employing a variety of contingencies with selected schedules of reinforcement (Honig, 1966; Reynolds, 1968) for targeted behaviors. The effectiveness of the consequent events is evaluated against baseline data which was collected during the observational cycle of assessment.

Reinforcement can follow any one of several schedules. Regardless of which schedule is selected, implicit in achieving maximal effectiveness is the immediate application of the prescribed contingency upon completion of the specified behavioral response. Meeting the requirements of response measurement and reward systems can be difficult. The diverse demands of managing and instructing students in either regular or specialized settings often prevent a teacher from providing immediate, appropriate feedback and consequences for the completion of sizeable amounts of written assignments or student tasks.

Research dealing with response measurement and reward systems is voluminous (Kazdin & Craighead, 1973; Krasner & Ullmann, 1965; Ullmann & Krasner, 1965). Research studies have been conducted in all types of experimental settings designed for normal and exceptional children. Most of these studies (Kazdin & Craighead, 1973; Ullmann & Krasner, 1965) have generally described contingencies in which the consequences were delivered to small numbers of students immediately following the behavior under consideration or modification. Alternative methods must be sought which are more conducive to the teaching demands of classroom settings.

Relatively few studies (Brown, 1973; Morris, 1969) of emotionally disturbed students have evaluated the effects of delaying consequences and/or feedback procedures in settings which are similar to those conditions present in special or regular classrooms in which immediate reinforcement may not be practical or possible. Delays of reward and feedback procedures for emotionally disturbed students need to be evaluated. If less tedious procedures can be found other than those presently being applied in programs for the emotionally disturbed students, they should be implemented. Brown (1973) investigated variations of delay and feedback procedures with emotionally disturbed adolescents.

His findings suggest that the usual procedures associated with response measurement and reward systems can be augmented in favor of practicality without forfeiting the effectiveness of the system. Presently, little research (Morris, 1969) has been directed at primary or intermediate school-aged, emotionally disturbed children which focuses on variations of delay of reward and feedback. The focus of this study was directed at evaluating alternatives which may lessen the impracticality of administering response measurement and reward systems.

CHAPTER II

REVIEW OF THE LITERATURE

Learning based theory approaches to educating children have been applied extensively in institutional, laboratory, and educational environments. Within these settings, moderately and mildly disturbed children have been exposed to response measurement and reward systems (Hall, Lund & Jackson, 1968; Packard, 1970; Patterson & Ebner, 1965; Quay, 1966; Walker & Buckley, 1968; Zimmerman & Zimmerman, 1962). A common component of the aforementioned research is the application of relatively immediate reinforcement; however, this application is not always feasible in educational settings with large groups of children. Additional studies and research (Brackbill & Kappy, 1962; Brown, 1973; Erickson & Lipsitt, 1960; Fagan & Witryol, 1966; Goldstein & Siegel, 1971; Hockman & Lipsitt, 1961; McKenzie, Clark, Wolf, Kothera & Benson, 1968; Perkins, Banks & Calvin, 1954; Piper, 1971; Schwartz & Hawkins, 1970; Sluyter & Hawkins, 1972; Zahn, 1967) are accumulating which support the premise that if other factors are present in combination with delayed consequences, the presumed deficits generally associated with delayed reward may be overcome or diminished.

The results of research dealing with the effects of immediate reinforcement as opposed to delayed reinforcement are illusive and contradictory. Many studies have demonstrated the superiority of immediate reinforcement in discrimination learning of children (Lipsitt, Castaneda & Kemble, 1959; Terrell & Ware, 1961; Ware & Terrell, 1961). However, other investigations have failed to support the crucial importance of applying immediate consequences (Brown, 1973; Brackbill & Kappy, 1962; Erickson & Lipsitt, 1960; Hockman & Lipsitt, 1961; Morris, 1969; Perkins, Banks & Calvin, 1954).

Immediate Reinforcement

Immediacy of reinforcement following a response is assumed to facilitate learning. Several learning theorists have supported the notion that immediate feedback information is important to learning and may provide the necessary operant reward that reinforces learning an item or task (Bugelski, 1964; Gagné, 1965; Skinner, 1968). Recent studies (Graubard, 1969; Hall, Lund & Jackson, 1968; Hawkins, 1967; Lovitt & Curtiss, 1969; Madsen, Becker, Thomas, Koser & Plager, 1968; Madsen, Becker & Thomas, 1968; Thomas, Becker

& Armstrong, 1968; Surratt, Ulrich & Hawkins, 1969; Wolf, Giles & Hall, 1968) of both academic and social behavior have demonstrated the effectiveness of applying response measurement and reward systems.

Delayed reinforcement has been viewed as counter productive in that delays of reward often allow for the emission of additional behaviors which retard or diminish the effectiveness of the consequating event (Reynolds, 1968). However, employment of consequating events for specified responses may not always be feasible. Considering the demands of most teachers, and others concerned with children, additional alternatives to immediate reinforcement have been devised and investigated.

Delayed Reinforcement

Mentally Retarded and Normal Children

A pioneer study dealing with retardates and delayed reinforcement reported by Piper (1971) indicated that delays of 23" had a deleterious effect on the attainment of discrimination learning tasks, whereas, immediate reinforcement produced excellent learning. Further studies (Hetherington, Ross & Pick, 1964; Ross, Hetherington & Wray, 1965) dealing with retarded and normal children have been conducted to investigate the effects of delay of reward. These studies suggest that (a) delays of reinforcement of 12" impede learning for both retarded and normal children, and (b) interpolated task conditions during intertrial intervals interfered with acquisition for both groups of children. These findings are incompatible with Brackbill & Kappy (1962).

Shoelkopf & Orlando (1966) found retardates made fewer mistakes at 6" and 12" as compared with 3" and 18" of delay. Candland & Manning (1966) using acquisition of a pursuit rotor task found no statistically significant differences between the treatment delays of 1", 3", 5", 9", and 10" respectively. Most recently, Piper (1971) examined the effects of delayed reinforcement and presentation of a stimulus worksheet on the learning of retarded children. His data indicated that mediating cues such as the additional cue provided by the stimulus worksheet just prior to reinforcement adequately overcame the decrement of learning generally experienced by retarded children in delays greater than 6".

Classroom-type Learning Tasks. Use of representative learning materials in research designed to assess the effects of delayed reinforcement or feedback has been limited. More (1969) studied the relationship between information feedback and retention. His results suggest that a curvilinear relationship exists between information feedback and retention. In his study, delays producing the optimal retention were 2½-hour and one day. Sassenrath (1972), using retention of prose material as the dependent variable, found that immediate feedback was as effective as postfeedback in maintaining retention. The illusiveness of delaying consequences or feedback appears to be a continuing problem confronted by researchers.

Preference for Delayed Reinforcement. Research has suggested that voluntary delay of reinforcement is a function of (a) the accuracy of the child's perception of time (Mischel, 1961), (b) a child's history of reinforcement (Walls & Smith, 1970), (c) age-related factors (Mischel & Metzner, 1962), and (d) the confidence of expectation of the child receiving a postponed reward (Mahrer, 1956; Mischel & Staub, 1965). Walls (1973) indicated that older children, eight years and older, exposed to a constant value-paradigm tended to voluntarily delay reward when compared to younger children. His findings parallel those of Mischel & Metzner (1962) with children of similar grade levels. Mischel (1961) in studying Trinidadian children found that those children who rated low on a standardized social responsibility scale and high on delinquent behavior showed a greater preference for immediate, smaller reinforcement.

Feedback and Delayed Reinforcement. Sluyter & Hawkins (1972) in summarizing data collected from three separate experiments found that feedback alone was not sufficient to modify behaviors. When effects were noted from either feedback to children and/or parents, the results achieved were relatively low in magnitude and duration.

The effects of reinforcement and feedback have also been studied by Walker & Buckley (1972). Using school-related arithmetic tasks, three experimental conditions were applied: (a) positive and negative feedback, (b) positive reinforcement and punishment, and (c) positive reinforcement and feedback plus punishment and negative feedback. The effects of these conditions were measured in terms of the children's response rates in academic performance. The third experimental condition produced the highest correct rate in scholastic performance. Feedback in conjunction with reinforcement appears to play a significant role in learning new behaviors.

Perceptual Mediating Responses. Perceptual mediating responses available during delay of reinforcement have been proposed as subsidiary response systems that facilitate discrimination outcomes by enhancing the salient or relevant stimulus cues (Kendler & Kendler, 1962; Zeaman & House, 1963). Selective observing responses can be promoted in various manners by (a) orienting instructions, (b) pretraining experiences, (c) availability of stimulus cues during delay, or (d) prevention of competing responses during delay. Orienting instructions given to children can provide them with a temporal mediator or goal orientation which can retard the interfering responses during delays of reinforcement.

Fagan & Witryol (1966) conducted research which supports the notion that the effects of delaying reinforcement can be greatly altered when children are instructed to focus on the learning task during the delay period. Wright & Smothergill (1967), using a procedure which provided stimulus availability during delay of reinforcement, found that the usual decrease in performance was not effected as would be expected in such a delay condition. Goldstein & Siegel (1971) conducted a similar study in which they provided opportunity for a given stimulus to remain visible to the subject during the period of delay. This stimulus availability during delay provided performance equal and comparable to those attained under conditions of immediate reinforcement.

Kindergarten children's discrimination learning in a study reported by Zahn (1967) was facilitated by providing several different combinations of discriminative cues during the postponement of reinforcement. It was postulated that the increased information present in the cue conditions provided an opportunity for additional learning to occur. According to Zahn (1967) one discriminative stimulus was as effective as two in generating excellent learning.

Brackbill & Kappy (1962) investigated the effects of delay of reinforcement on the acquisition and retention of the learning of third grade children. Delays of reward during acquisition facilitated retention of material learned. This retention, in the opinion of the researchers, was facilitated by the fact that the subjects were able to make use of the response produced cues. This usage of cues was thought to promote a bridging or mediating effect between initial learning and retention testing. Various other studies lend credence to the position that delays, including periods up through and including one week, increase retention (Brackbill, Wagner & Wilson, 1964; English & Kinzer, 1966; Sassenrath & Yonge, 1968).

Emotionally Disturbed

Data generated by McKenzie, Clark, Wolf, Kothera & Benson (1968) reported that delayed reinforcement techniques can be made effective by providing token reinforcement at school and back-up reinforcers at home. In both conditions, at school and at home, neither reinforcers were given immediately following the specified behavioral requirements but were considerably delayed. Similar delayed conditions have been applied with other groups of emotionally disturbed students (O'Leary & Becker, 1967; Glavin, Quay, Annesley & Werry, 1971).

Video-tape recordings have been implemented in providing distinctive response cues following an extended time interval (Schwartz & Hawkins, 1970). Taped sessions of a mildly, maladjusted student's behavior during math periods were recorded. After school the child viewed the video-tape and received consequences for appropriate levels of behavior exhibited during the academic session. These techniques capably modified the maladaptive behaviors rapidly with an unusual, generalized effect experienced in another area of the school curriculum, namely spelling.

Effects of delayed consequences on acquisition and retention of simultaneous discrimination tasks with emotionally disturbed students were reported by Morris (1969). Four conditions were applied: (a) high value-delay of reward, (b) high reward-immediate reward, (c) low reward value-delay of reward, and (d) low reward value-immediate reward. On acquisition of the learning tasks, no significant differences were found among the various experimental conditions. Value of the reward and the interaction between delay of reward and reward value were found to be significant on the retention measures conducted eight days following the last exposure to the learning task.

Brown (1973) exposed emotionally disturbed adolescents to several experimental conditions involving various delays of consequences in conjunction with or without response produced cues. His findings suggest that delays up to 3-hours, when accompanied by response produced cues, do not significantly alter the learning of emotionally disturbed adolescents.

Summary

Results of studies dealing with the effects of delayed consequences are difficult to compare on the basis of differences in (a) population studies, (b) time intervals in delays investigated, (c) tasks and materials employed, and (d) procedures applied. However, documentation has been cited which suggests that the decrements in learning associated with delaying consequences may be surmounted by presenting stimulus produced cues in concert with the deferred reward.

Only two studies (Brown, 1973; Morris, 1969) have investigated the effects of delaying consequences on learning of emotionally disturbed students. A study directed at younger, elementary school-aged children would provide an extension of research already conducted and a contribution to existing knowledge regarding response measurement and reward systems.

CHAPTER III

PROCEDURES

Definitions

For the purpose of this investigation, the following definitions were used:

Emotionally Disturbed Children. Children, 7 to 11 years of age who have been identified by a school psychologist as being emotionally disturbed and who have been assigned to a special class.

Celeration Coefficient. The ratio of the predicted log rate of responding at day seven to day one; predicted rates calculated by linear regression.

Celeration Ratio. The log value of the difference between the celeration coefficient of correct responding and the celeration coefficient of incorrect responding.

Discrimination Learning Task. A series of paired nonsense geometric figures (Brown, 1973) presented in sets of four on 8½ x 11 sheets of paper designed to assess the components of learning described in the problem.

Statement of the Problem

The major purpose of this investigation was to assess the impact of various time spans of delayed consequence as they interacted with two types of feedback on the learning of emotionally disturbed children. These two types of feedback were (a) discriminative cue sheets presented prior to the consequating event, and (b) absence of discriminative cue sheets at consequation. The spans of delay which were investigated included (a) delays of 10"-45", (b) delays of 15', and (c) delays of 3-hours. These spans of delay approached some of the typical feedback intervals of response measurement and reward systems common to regular and special classroom settings.

The influence of the six conditions on the learning of emotionally disturbed children were studied as they effected the (a) log rates of correct responding, (b) number of correct responses, (c) response times, and (d) celeration ratios. These six conditions included:

1. 10"-45" delay of consequence, discriminative cue sheets attendant.
2. 10"-45" delay of consequence, discriminative cue sheets absent.

3. 15' delay of consequence, discriminative cue sheets attendant.

4. 15' delay of consequence, discriminative cue sheets absent.

5. 3-hour delay of consequence, discriminative cue sheets attendant.

6. 3-hour delay of consequence, discriminative cue sheets absent.

Hypotheses

Hypothesis I.

There will be no significant differences between the log rates of correct responding under the two types of feedback consequence (with or without discriminative cue sheets).

> Corollary Ia. There will be no significant differences between the log rates of correct responding under the three conditions of delay (10"-45", 15', and 3-hours).
>
> Corollary Ib. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the log rates of correct responding.

Hypothesis II.

There will be no significant differences between the number of correct responses under the two types of feedback consequence.

> _Corollary IIa_. There will be no significant differences between the number of correct responses under the three conditions of delay.

> _Corollary IIb_. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the number of correct responses.

Hypothesis III.

There will be no significant differences between the response times under the two types of feedback consequence.

> _Corollary IIIa_. There will be no significant differences between the response times under the three conditions of delay.

> _Corollary IIIb_. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the response times.

Hypothesis IV.

There will be no significant differences between the celeration ratios under the two types of feedback consequence.

> _Corollary IVa_. There will be no significant differences between the celeration ratios under the three conditions of delay.

> _Corollary IVb_. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the celeration ratios.

Subjects

The subjects for this investigation were children selected from self-contained special education classes for the emotionally disturbed at Sidney Lanier Elementary School and Littlewood Elementary School in Alachua County, Florida. These children represented grade levels second through fifth and ranged in age from 7 to 11 years (Appendix A).

Discriminative Learning Task

The discriminative learning tasks used in this investigation were derived from a study conducted by Brown (1973). The discriminative learning task consisted of 48 unique, geometric figures (Appendix B) which were randomly grouped by a subroutine of the Statistical Analysis System (Service, 1972) to form 24 pairs. Six sets of four pairs each were randomly assigned to each child. Each of the sets were randomly grouped especially for each child. The six distinctive sets of four pairs each provided the discriminative learning tasks for each of the six conditions.

One figure in each of the 24 pairs was assigned as correct by the investigator using a subroutine of the Statistical Analysis System (Service, 1972). Each stimulus pair was reproduced on an 8½ x 11 sheet of paper which became known as discriminative cue sheets. The position of the correct stimulus for each pair was randomly counter balanced which prevented the correct stimulus from occurring predominately in any one position. The order of presentation for each of the distinctive sets of discriminative cue sheets was different for each subsequent day. In addition, the order of presentation of each condition was randomized for each subsequent day (Table 1).

The child's task was to learn the correct figure for each unique pair in each set under the appropriate, assigned condition. Initially, as each child was exposed to each condition with its respective set of discriminative cue sheets, the child had no information upon which to base his decision. However, after each successive day, the child had an opportunity to apply what he had learned from each of the imposed conditions. Complete administrative procedures appear in Appendix C.

A child indicated his choice for each pair by circling that figure thought to be the correct one. In order to facilitate processing, each discriminative stimulus was numbered which also facilitated the randomization and feedback procedures.

TABLE 1

ORDER OF PRESENTATIONS OF RESPONSE CONDITIONS REPORTED BY DAY

	Order of Presentation					
	1st	2nd	3rd	4th	5th	6th
Day	Response Conditions					
1	F	D	E	A	C	B
2	A	E	F	C	D	B
3	C	A	E	B	F	D
4	F	A	D	B	E	C
5	A	B	E	F	C	D
6	F	B	E	C	D	A
7	A	E	C	D	F	B
8	F	C	E	A	D	B
9	C	D	F	B	A	E
10	F	E	D	B	A	C

Data Analysis

Data drawn from the four dependent measures (a) log rates of correct responding, (b) number of correct responses, (c) response times, and (d) celeration ratios were evaluated utilizing an analysis of variance repeated measures design (Winer, 1971). The four way and the three way analysis of variance are represented in Tables 2 and 3 respectively. Specifically, the following analyses were performed:

1. a four way analysis of variance repeated measures design on the log rates of correct responding;
2. a four way analysis of variance repeated measures design on the number of correct responses;
3. a four way analysis of variance repeated measures design on the response times;
4. a three way analysis of variance repeated measures design on the celeration ratios.

The overall test of significance applied for each analysis of variance was the F ratio (Winer, 1971) at the .01 level of significance. When a null hypothesis was rejected, Duncan's New Multiple Range Test (Duncan, 1955) was utilized. This test provides a procedure for isolating the source of significance established by the F ratio by carrying out pairwise comparisons among means.

TABLE 2

TABULAR REPRESENTATION OF THE FOUR WAY ANALYSIS OF VARIANCE, REPEATED MEASURES DESIGN FOR THE LOG RATES OF CORRECT RESPONDING, THE NUMBER OF CORRECT RESPONSES, AND THE RESPONSE TIMES

	a_1			a_2		
	b_1	b_2	b_3	b_1	b_2	b_3
	$c_{1...10}$	$c_{1...10}$	$c_{1...10}$	$c_{1...10}$	$c_{1...10}$	$c_{1...10}$
d_1	$X_{1jkm}\cdots$	$\cdots$	$\cdots$	$X_{2jkm}\cdots$	$\cdots$	$\cdots$
.	.		.	.		.
.	.		.	.		.
d_7	$X_{11km}\cdots$	$X_{12km}\cdots$	$\cdots$	$X_{21km}\cdots$	$X_{22km}\cdots$	$\cdots$
.	.	.	.	.		.
.	.	.	.	.		.
d_{13}	$X_{111m}\cdots$	$X_{121m}\cdots$	X_{131m}	$X_{211m}\cdots$	$X_{221m}\cdots$	X_{231m}

$SS_{\text{Log Rates of Correct Responding}}$ or
$SS_{\text{Number of Correct Responses}}$ or
$SS_{\text{Response Times}}$

$$= \mu + a_i + b_j + c_k + d_m + ab_{ij} + ac_{ik} + ad_{im} + bc_{jk} + bd_{jm} + cd_{km} + abc_{ijk} + abd_{ijm} + acd_{ikm} + bcd_{jkm} + e_{ijkm}$$

a_i = With or Without Feedback Consequences
$i = 1, 2$
b_j = Delays of 10"-45", 15' 3-hours
$j = 1, 2, 3$
c_k = Days
$k = 1, 2, 3, . . . 10$
d_m = Subjects
$m = 1, 2, 3, . . . 13$
X = Observations (Log Rates of Correct Responding, Number of Correct Responses, or Response Times)

TABLE 3

TABULAR REPRESENTATION OF THE THREE WAY ANALYSIS OF VARIANCE REPEATED MEASURES DESIGN FOR THE CELERATION RATIOS

	a_1			a_2		
	b_1	b_2	b_3	b_1	b_2	b_3
d_1	$X_{1jkm}\cdots\cdots$	$\cdots\cdots$	$\cdots\cdots$	$X_{2jkm}\cdots\cdots$	$\cdots\cdots$	$\cdots\cdots$
$\vdots$	$\vdots$		$\vdots$	$\vdots$		$\vdots$
d_7	$X_{11km}\cdots\cdots$	$X_{12km}\cdots\cdots$	$\cdots$	$X_{21km}\cdots\cdots$	$X_{22km}\cdots\cdots$	$\cdots$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
d_{13}	$X_{111m}\cdots\cdots$	$X_{121m}\cdots\cdots$	X_{131m}	$X_{211m}\cdots\cdots$	$X_{221m}\cdots\cdots$	X_{231m}

$$SS_{\text{Celeration Ratio}} = \mu + a_i + b_j + d_m + ab_{ij} + ad_{im} + bd_{jm} + e_{ijm}$$

a_i = With or Without Feedback Consequence
$i = 1, 2$
b_j = Delays of 10"-45", 15', 3-hours
$j = 1, 2, 3$
d_m = Subjects
$m = 1, 2, 3, \ldots 13$
X = Observation of Celeration Ratio

CHAPTER IV

RESULTS AND DISCUSSION

Analysis of Data

The interactional effects of two types of feedback consequence with three conditions of delay on the learning of emotionally disturbed children were evaluated by applying an analysis of variance repeated measures design (Winer, 1971). The variables of the number of correct responses and the response times in seconds which were required to respond to the discriminative cue sheets for each of the specified conditions were recorded (Appendix D). All calculations and variable transformations were performed with double precision by the Northeast Regional Data Center IBM 370/165 of the University System of the State of Florida utilizing the Statistical Analysis System (Service, 1972). Employing this system, the variables of (a) number of correct responses and (b) response times were processed in order to provide data for the other specified variables, namely: (a) the log rates of correct and incorrect responding, and (b) the celeration ratios.

The two log rates of responding were the $\log_{10}$ values of the number of correct or incorrect responses per minute. A log measure of this type provided an accurate frequency indicator of behavioral responses such as the number of discriminative cues circled correctly with regard to minutes elapsed.

Celeration coefficients for correct and incorrect responding (Appendices E and F) were computed by measuring the ratio of the change in frequency of the log rates of responding from day one to day seven. Functionally, these celeration coefficients are related to the slope of the line of best fit (Skypek, 1971). A linear regression subroutine of the Statistical Analysis System (Service, 1972) was utilized to calculate the celeration coefficients. Celeration ratios were then computed by dividing the celeration coefficients of correct responding by the celeration coefficients of incorrect responding (Appendix G). A measure of contrast between the celerations of correct and incorrect responding is provided by the celeration ratio.

The .01 level of confidence was selected as the determinant of statistical significance. When the F ratios were significant at the .01 level, the Duncan's New Multiple Range Test (Duncan, 1955) was applied with the exception of situations where only two means were involved. An evaluation and discussion of each of the null hypotheses are presented in the subsequent section.

Evaluation of the Null Hypotheses

Hypothesis I.

There will be no significant differences between the log rates of correct responding under the two types of feedback consequence (with or without discriminative cue sheets).

A four way analysis of variance repeated measures design (Winer, 1971) of the log rates of correct responding was employed. Eighty-two percent of the variance measured was accounted for by the statistical model which was selected (Table 2). As indicated in Table 4, the F ratio of 16.465 exceeded the .01 level of significance for the two types of feedback consequence. The mean log rate of correct responding when the discriminative cue sheets were attendant at consequation was 0.797; whereas, the mean log rate for the discriminative cue sheets absent at consequation was 0.714. The interpretation of this main effect must be qualified as a result of significant second order interactions (Winer, 1971; Kirk, 1968) with F ratios of 2.465 and 2.056 which include this main effect.

> Corollary Ia. There will be no significant differences between the log rates of correct responding under the three conditions of delay (10"-45", 15', and 3-hours).

TABLE 4

FOUR WAY ANALYSIS OF VARIANCE REPEATED MEASURES DESIGN OF SUBJECTS, DAYS, FEEDBACK CONSEQUENCE, AND DELAYS FOR THE LOG RATES OF CORRECT RESPONDING

Source of Variance	df	SS	MS	F ratio
Subjects	12	11.701	0.975	11.656*
Days	9	2.865	0.318	3.806*
Feedback Consequence	1	1.377	1.377	16.465*
Delays	2	0.481	0.240	2.857
Subjects X Days	108	15.813	0.146	1.750*
Subjects X Feedback Consequence	12	1.973	0.164	1.965
Subjects X Delays	24	7.590	0.316	3.781*
Days X Feedback Consequence	9	0.886	0.098	1.177
Days X Delays	18	3.964	0.220	2.632*
Feedback Consequence X Delays	2	0.265	0.133	1.583
Subjects X Days X Feedback Consequence	108	10.809	0.100	1.196
Subjects X Days X Delays	216	17.234	0.080	0.954
Subjects X Feedback Consequence X Delays	24	4.950	0.206	2.465*
Days X Feedback Consequence X Delays	18	3.095	0.172	2.056*
Residual	216	18.070	0.084	
Total	779	101.073		

*Significant at .01

The means for the three conditions of delay were (a) 10"-45", 0.751; (b) 15', 0.789; and (c) 3-hours, 0.728. The F ratio of 2.857 (Table 4) failed to reveal any significant differences between the three conditions of delay at the .01 level of confidence. The interpretation of the lack of significance as demonstrated by the F ratio of 2.857 is complicated by the presence of the main effect of delays in first and second order interactions of significance (Winer, 1971; Kirk, 1968) with F ratios of 3.781, 2.632, 2.465, and 2.056 respectively.

> Corollary Ib. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the log rates of correct responding.

The means for the interaction of the three delay conditions and the two types of feedback consequence are displayed in Table 5.

TABLE 5

MEAN VALUES OF LOG RATES OF CORRECT RESPONDING REPORTED FOR THE INTERACTION OF FEEDBACK CONSEQUENCE AND DELAYS

With Feedback Consequence			Without Feedback Consequence		
10"-45"	15'	3-hours	10"-45"	15'	3-hours
0.780	0.817	0.795	0.722	0.760	0.660

The F ratio of 1.583 failed to indicate any significant differences between the delay conditions and the two types of feedback consequence on the log rates of correct responding. According to Winer (1971) and Kirk (1968), the interpretation of the lack of significance as demonstrated by the F ratio of 1.583 must be qualified as a result of significant second order interactions which contain the main effects of feedback consequence and delays. The significant F ratios of 2.465 and 2.056 are reported in Table 4.

The analysis of the log rates of correct responding provided conflicting evidence with respect to retaining or rejecting the null hypothesis and related corollaries. Because of the significant corresponding F ratios of some of the main effects under investigation and some of the first and second order interactions, the interpretation of the results cannot be definitive. The combinatorial nature of the interactions themselves and the lack of any precise differences between the ordered means as substantiated by the Duncan's New Multiple Range Test (Duncan, 1955) limit the level of preciseness with which the interactions can be interpreted.

Feedback consequence with discriminative cue sheets attendant may enhance the log rates of correct responding. Various lengths of delay (10"-45", 15', and 3-hours) appeared to have no significant effect on the log rates of correct responding. Selected combinations of delay in conjunction with discriminative cue sheets present may positively effect the log rates of correct responding.

Hypothesis II.

There will be no significant differences between the number of correct responses under the two types of feedback consequence.

A four way analysis of variance repeated measures design (Winer, 1971) of the number of correct responses was utilized. The multiple correlation coefficient (Winer, 1971) of 0.802 signifies that 80% of the variance measured was accounted for in the statistical model (Table 2). As indicated in Table 6, the F ratio of 39.627 exceeded the .01 confidence level for the two types of feedback consequence. This F ratio represents the highest numerical value possible when the Statistical Analysis System (Service, 1972) is employed. The mean number of correct responses when the discriminative cue sheets were attendant at consequation was 2.269; whereas, the mean number of correct responses for the discriminative cue sheets absent at consequation was only 1.885. According to Winer (1971) and Kirk (1968), the interpretation of the significance of this main effect must be qualified as a result of a significant first order interaction which was an F ratio of 3.767, and a significant second order

TABLE 6

FOUR WAY ANALYSIS OF VARIANCE REPEATED MEASURES DESIGN OF SUBJECTS, DAYS, FEEDBACK CONSEQUENCE, AND DELAYS FOR THE NUMBER OF CORRECT RESPONSES

Source of Variance	df	SS	MS	F ratio
Subjects	12	27.920	2.327	3.072
Days	9	7.473	0.830	1.096
Feedback Consequence	1	30.011	30.011	39.627*
Delays	2	3.249	1.624	2.145
Subjects X Days	108	95.310	0.883	1.165
Subjects X Feedback Consequence	12	34.238	2.853	3.767
Subjects X Delays	24	113.918	4.747	6.267*
Days X Feedback Consequence	9	5.001	0.556	0.734
Days X Delays	18	15.315	0.851	1.123
Feedback Consequences X Delays	2	0.484	0.242	0.320
Subjects X Days X Feedback Consequence	108	79.915	0.740	0.977
Subjects X Days X Delays	216	161.851	0.749	0.989
Subjects X Feedback Consequence X Delays	24	69.415	2.892	3.819*
Days X Feedback Consequence X Delays	18	18.849	1.047	1.383
Residual	216	163.585	0.757	
Total	779	826.537		

*Significant at .01

interaction which has an F ratio of 3.819.

> Corollary IIa. There will be no significant differences between the number of correct responses under the three conditions of delay.

The means for the three conditions of delay were (a) 10"-45", 2.071; (b) 15', 2.158; and (c) 3-hours, 2.004. The F ratio 2.145 (Table 6) did not indicate any significant differences between the three conditions of delay at the .01 level of confidence. The interpretation of the lack of significance is complicated by the presence of the main effect of delays in a significant first and second order interaction with F ratios of 6.267 and 3.819 respectively.

> Corollary IIb. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the number of correct responses.

The means for the interaction of the three delay conditions and the two types of feedback consequence are displayed in Table 7.

TABLE 7

MEAN VALUES OF THE NUMBER OF CORRECT RESPONSES REPORTED FOR THE INTERACTION OF FEEDBACK CONSEQUENCE AND DELAY

With Feedback Consequence			Without Feedback Consequence		
10"-45"	15'	3-hours	10"-45"	15'	3-hours
2.277	2.369	2.162	1.862	1.946	1.846

The F ratio of 0.320 failed to indicate significant differences between the delay conditions and two types of feedback consequence on the number of correct responses. The explanation of the lack of significance as shown by the F ratio of 0.320 is limited as a result of a significant second order interaction (Winer, 1971; Kirk, 1968) which contains the main effects of feedback consequence and delays. The significant F ratio of 3.819 of this interaction is provided in Table 6.

The analysis of the number of correct responses provided some evidence for rejecting the null hypothesis. The F ratio of 39.627 of feedback consequence (Table 6) greatly exceeded the minimum numerical value required to establish significant differences at the .01 level of confidence. It appeared that the presence of the discriminative cue sheets at consequation positively effected the number of correct responses made by the subjects. The subjects appeared to respond differentially to the three conditions of delay (10"-45", 15' and 3-hours). No single condition proved to be more efficient than any other condition in achieving more correct responses, nor did any combination of feedback consequence with the three conditions of delay significantly increase the number of correct responses. The second order interaction of subjects, feedback consequence, and delays was found to be significant at the .01 level; however, the Duncan's New Multiple Range Test (Duncan, 1955) was unable to isolate any specific combinations of ordered means which were significantly different from other ordered means in generating higher levels of correct responding. Therefore, the null hypothesis and related corollaries cannot be decisively rejected or accepted. The analysis indicated that subjects responded differentially to the types of feedback consequence and/or the three conditions of delay or various combinations of feedback consequence and delays.

Hypothesis III.

There will be no significant differences between the response times under the two types of feedback consequence.

In order to determine the differences between the response times under the two types of feedback consequence a four way analysis of variance repeated measures design

(Winer, 1971) was employed. The multiple correlation coefficient (Winer, 1971) of 0.833 signifies that 83% of the variance measured was accounted for in the statistical model (Table 2). The results of the analysis are reported in Table 8. The means of the with and without feedback consequence, 22.882 and 23.964 respectively, resulted in an F ratio of 0.951 which failed to attain the specified .01 level of confidence. The meaning of the lack of significance as indicated by Winer (1971) and Kirk (1968) is confounded by the occurrence of the main effect of feedback consequence in two significant first and second order interactions. The F ratios for the first order interactions are 2.704 and 8.552; whereas, the F ratios for the second order interactions are 1.592 and 2.379.

> Corollary IIIa. There will be no significant differences between the response times under the three conditions of delay.

The three conditions of delay had means of (a) 10"-45", 24.381; (b) 15', 22.065; and (c) 3-hours, 23.812. The F ratio of 1.770 (Table 8) failed to identify significance at the .01 level of confidence. Significant F ratios of 8.552 for a first order interaction and 2.379 for a second order interaction confounded the interpretation of the main effect of the delays.

TABLE 8

FOUR WAY ANALYSIS OF VARIANCE REPEATED MEASURES DESIGN
OF SUBJECTS, DAYS, FEEDBACK CONSEQUENCE, AND
DELAYS FOR THE RESPONSE TIMES

Source of Variance	df	SS	MS	F ratio
Subjects	12	35545.04	2962.09	13.531*
Days	9	11168.56	1240.95	5.668*
Feedback Consequence	1	208.22	208.22	0.951
Delays	2	775.13	387.57	1.770
Subjects X Days	108	50163.89	464.48	2.122*
Subjects X Feedback Consequence	12	1916.57	159.71	0.730
Subjects X Delays	24	5926.67	246.94	1.128
Days X Feedback Consequence	9	5327.90	591.99	2.704*
Days X Delays	18	17515.87	973.10	4.445
Feedback Consequence X Delays	2	3744.33	1872.16	8.552*
Subjects X Days X Feedback Consequence	108	37656.15	348.67	1.592*
Subjects X Days X Delays	216	53864.33	249.37	1.139
Subjects X Feedback Consequence X Delays	24	3916.74	163.20	0.745
Days X Feedback Consequence X Delays	18	9372.52	520.70	2.379*
Residual	216	47283.08	218.90	
Total	779	284384.98		

*Significant at .01

> Corollary IIIb. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the response times.

The means for the interaction of three conditions of delay and the two types of feedback consequence are displayed in Table 9.

TABLE 9

MEAN VALUES OF RESPONSE TIMES REPORTED FOR THE INTERACTION OF FEEDBACK CONSEQUENCE AND DELAY

With Feedback Consequence			Without Feedback Consequence		
10"-45"	15'	3-hours	10"-45"	15'	3-hours
25.215	23.269	20.162	23.569	20.862	27.462

At the .01 level of confidence with an F ratio of 2.704, significant interactions of the three delay conditions and the two types of feedback consequence were achieved (Table 8). However, the Duncan's New Multiple Range Test (Duncan, 1955) was not effective in detecting any significant differences between the six ordered means of 27.462, 25.215, 23.569, 23.269, 20.862, and 20.162. The interpretation of the significance of the first order interaction of feedback consequence and delays with an F ratio of 2.704, must be qualified in view of a significant second order interaction with an F ratio of 2.379 which contains feedback consequence and delays.

The analysis of the response times provided meager evidence which would suggest rejection of the null hypothesis and related corollaries. The first order interaction of feedback consequence and delays was significant at the .01 level of confidence; however, a significant second order interaction complicated the interpretation of the significance. As a group the subjects tended to respond more rapidly to the sets of discriminative cue sheets on subsequent days.

Hypothesis IV.

> There will be no significant differences between the celeration ratios under the two types of feedback consequence.

A three way analysis of variance repeated measures design (Winer, 1971) of the celeration ratios was utilized. As indicated in Table 10, the F ratio of 3.486 failed to attain the .01 level of significance for the two feedback consequence types.

> Corollary IVa. There will be no significant differences between the celeration ratios under the three conditions of delay.

TABLE 10

THREE WAY ANALYSIS OF VARIANCE REPEATED MEASURES DESIGN OF SUBJECTS, DELAYS, AND FEEDBACK CONSEQUENCE FOR THE CELERATION RATIOS

Source of Variance	df	SS	MS	F ratio
Subjects	12	84.227	7.019	0.491
Delays	2	39.848	19.924	1.395
Feedback Consequence	1	49.790	49.790	3.486
Subjects X Delays	24	500.904	20.871	1.461
Subjects X Feedback Consequence	12	309.941	25.828	1.808
Delays X Feedback Consequence	2	55.566	27.783	1.945
Residual	24	342.862	14.286	
Total	77	1383.139	17.963	

Under the three conditions of delay, the F ratio of 1.395 at the .01 level of confidence was not reached. This interpretation is not complicated by any significant first or second order interactions.

> Corollary IVb. There will be no significant interactions between the three conditions of delay and the two types of feedback consequence on the celeration ratios.

The F ratio of 1.945 of the interaction of the three delays and two feedback consequence types did not approach the selected .01 level of significance. No other interactions or main effects were found to be significant.

The analysis of the celeration ratios failed to reveal any significant terms of the statistical model tested. Regardless of the main effect or interaction chosen for evaluation, the analysis of celeration ratios provided no evidence which would suggest rejecting the null hypothesis and related corollaries.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The purpose of the present investigation was to examine the effects of two types of feedback consequence and three conditions of delay as they effected the learning of emotionally disturbed children. Statistical analysis of the data collected from (a) log rates of correct responding, (b) number of correct responses, (c) response times, and (d) celeration ratios demonstrated that the presentation of the discriminative cue sheets at consequation did appear to enhance the number of correct responses, and conceivably the log rates of correct responding. Delaying the presentation of the consequence feedback 15' or 3-hours did not effect the learning of the emotionally disturbed children participating in this study. However, some of the significant second order interactions containing the delay term of the statistical model indicated that there may be some subtle distinguishing effects exerted by various combinations of delay and feedback consequence.

These combinations may accelerate the log rates of responding or heighten the number of correct responses realized. With respect to response times, neither the feedback consequence nor the delay conditions effected the time required to respond to the sets of discriminative cue sheets.

The effects as measured by the celeration ratios indicated that neither feedback consequence nor the three conditions of delay had any perceptible influence on the rates of learning. Furthermore, no single combinations of feedback consequence and delays emerged which influenced the rates of correct responding.

Several implications emanate from this research which deal with response measurement and reward systems. Related studies (Brown, 1973, Sluyter & Hawkins, 1971, Schwartz & Hawkins, 1970) have provided evidence suggesting that the presence of certain learner produced cues, after extended periods of delay, rivaled or equaled the gains of learning produced under conditions of immediate reward and feedback. This investigation affirms the concept that regardless of the delay involved between task completion and task feedback with reward, learning is enhanced when the product of the learner is returned for personal examination at the time of consequation.

In order to encourage initial responding to a prescribed task, it is often desirable to arrange a contingency system which is designed to provide continuous and immediate consequences. Although immediate reinforcement is sometimes necessary, teachers should be alert for behavioral indicators which suggest that a learner is ready for a reward system which is not only less demanding of the teacher, but one which more nearly approximates the contingency schedules existing in most educational settings.

Furthermore, the results of this investigation connote that the learning of the emotionally disturbed children was not significantly effected by any of the delay conditions. It appears then that some emotionally disturbed children learn as efficiently under delayed conditions of reward and feedback as under immediate feedback reward conditions. In conclusion, the results of the present investigation reaffirm the notion that each child is unique and will respond differentially to the demands of any response measurement and reward system.

Recommendations

Several possibilities for further research with emotionally disturbed students are suggested by the results of this study.

1. An investigation of other spans of delay may provide further documentation of the influence of delays on learning. This is especially relevant since many

written school assignments are not returned until the following day or perhaps several days later.

2. The amount of expense incurred in providing each child with a monetary reward makes this type of reward system prohibitive even on a limited basis. Therefore, research focusing on other types of incentives and rewards should be made in an attempt to study the effects of rewards which are within the natural school environment.

3. Research directed at actual classroom learning tasks under various conditions of delay would provide evidence which may have more direct application for actual teaching procedures and classroom practices.

4. Research dealing with preference for delay of reward among various school-aged populations of emotionally disturbed students should be conducted. Such research could provide teachers of emotionally disturbed students with information which may influence the application of immediate or delayed reward techniques with various school-aged populations.

APPENDICES

APPENDIX A

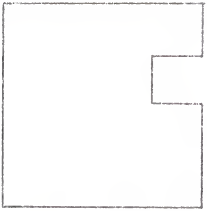
GRADE PLACEMENT AND CHRONOLOGICAL AGE REPORTED FOR EACH SUBJECT

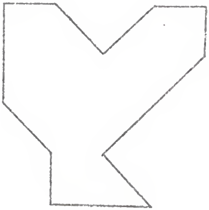
GRADE PLACEMENT AND CHRONOLOGICAL AGE REPORTED FOR EACH SUBJECT

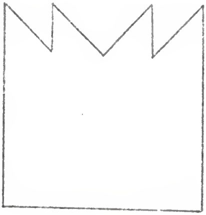
Subject	Grade Placement	Chronological Age Reported in Years and Months
1	2nd	7-7
2	5th	11-2
3	5th	11-9
4	3rd	8-6
5	5th	11-4
6	4th	9-9
7	5th	11-3
8	5th	10-7
9	3rd	9-5
10	5th	10-7
11	2nd	7-9
12	4th	9-9
13	3rd	8-10

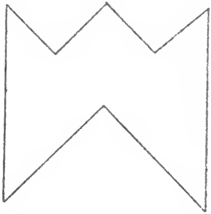
APPENDIX B

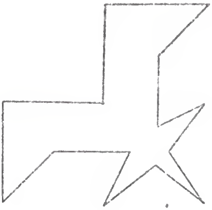
GEOMETRIC FIGURES

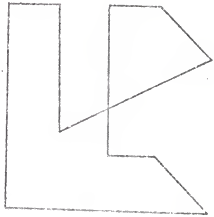


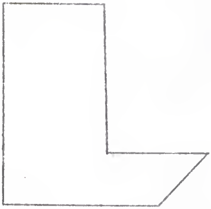


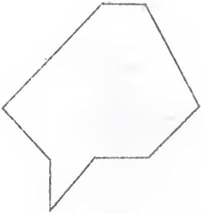


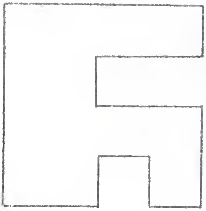


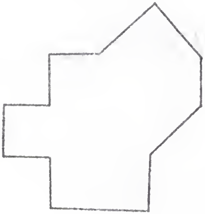


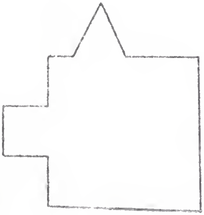


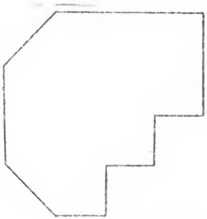


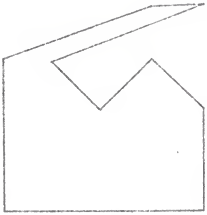


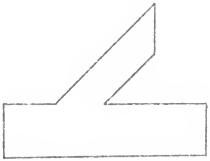


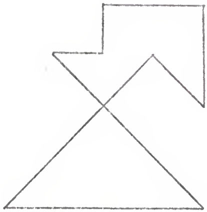


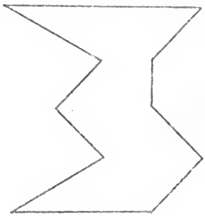


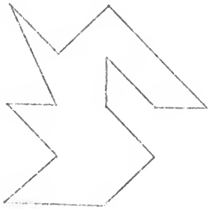


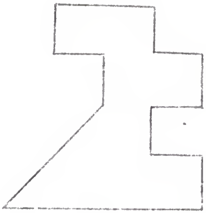


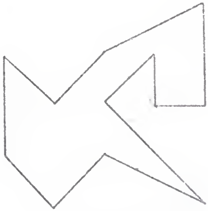


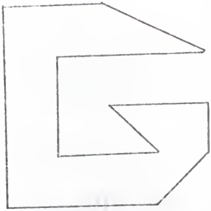


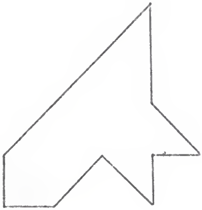


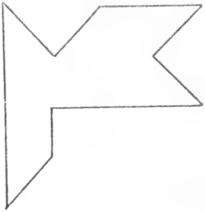


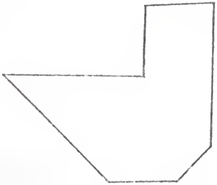


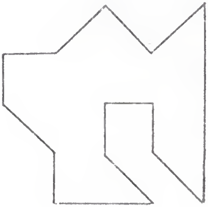


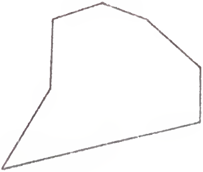


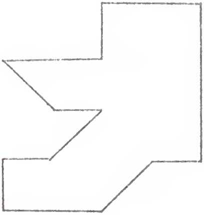


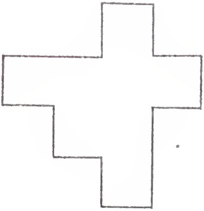


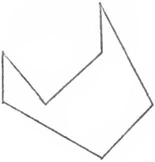


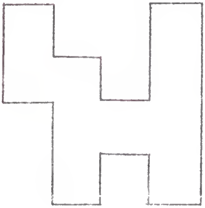


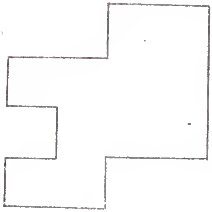


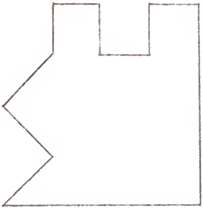


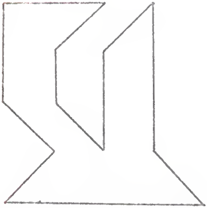


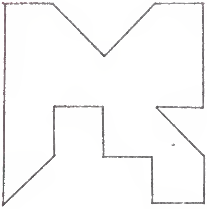


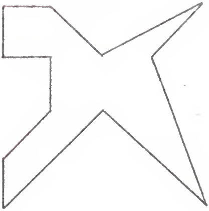


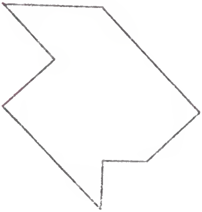


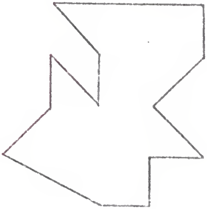


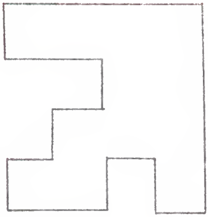


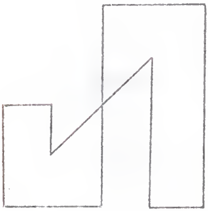


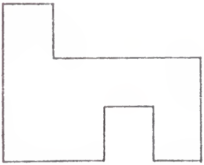


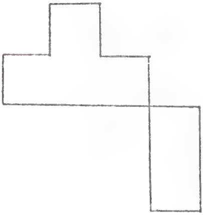


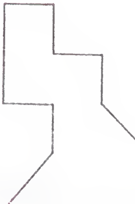


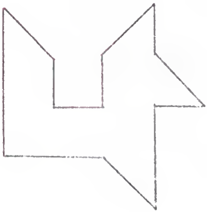


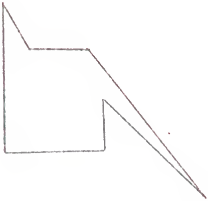


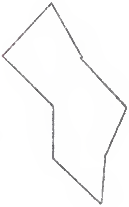


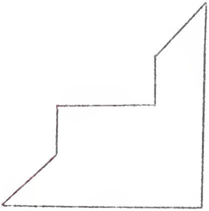


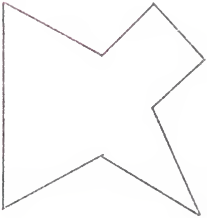


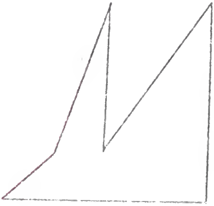


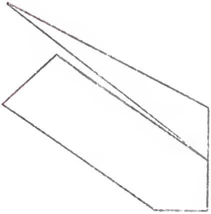












APPENDIX C

ADMINISTRATION PROCEDURES

ADMINISTRATION PROCEDURES

In order to prepare each child to participate in the investigation and the learning task, the investigator provided each child with a simple explanation of the procedures and purposes of the investigation prior to the actual data collection. Each child also had an opportunity to gain competence in understanding the nature of the learning task and how he would actually be expected to respond by participating in a simulation of some of the experimental conditions. The geometric figures used in the orientation session were derived from a previous investigation (T. Piper, personal communication, April 25, 1974). During this orientation, the investigator expressed the importance of each child's attendance at school during the investigation. Consistent attendance was encouraged through an incentive which was given to each child maintaining a perfect attendance during the duration of the study.

Orientation Session

The orientation session began by the investigator introducing himself and stating:

During the next ten school days, we're going to play a game. If you are here each day on time and in your seats, I will give you a nickel. If you are here all ten school days, and complete all of the games, I will give each of you a dollar at the end of the experimental period. This game will help me find out how you learn. The game is very simple. I will help you each time we play the game. Today, I have brought some of the parts of the games with me so you will know how to play it when I come tomorrow.

Here, I have some sheets of paper.

Each time you play each game, you will be given four of these sheets. On each sheet as you will see are two "crazy" figures. You are to guess which figure of the two is the correct one. If you guess the correct one you will be given a nickel. Now let's try one.

Each of you will now be given a sheet. When I say begin, turn the sheet over and circle the "crazy" figure which you think is the correct one. When you have done that, raise your hand and I will come to your desk and pick up the sheet. As soon as I have corrected it, I will hand it back and tell you if you drew a circle around the correct figure. If you are correct, you will immediately receive a nickel. Now turn your sheets over, take a guess and begin!

(After this procedure was implemented, the investigator said:)

Now we are going to play our game again, and this time I will give you two sheets. You may earn two nickels this time if you choose correctly. When I say begin, turn your sheets over and we will play the same game with two sheets instead of one. If you look closely, you will find one sheet this time that was the same as the first sheet you did. Try and remember which "crazy" figure on this sheet was the correct one. Then you won't have to guess in order to get a nickel.

When you have finished circling your answers, please raise your hand and I will come to your desk to pick up your sheets, let you know which ones you got correct, and give you a nickel for the ones you circled correctly. Are there any questions? Begin!

(After presenting this sequence of the orientation, the investigator said:)

You are all doing a fine job. So I can be sure that you all know what you are doing. Let's try three sheets this time. Try and remember the last two sheets you just did, because you are going to see them again. In this way, you won't have to guess at which figures you should circle because you will probably already know which ones they are.

Please don't start until I say begin. When you're finished raise your hand, and I will come to your desk, check your circled answers, and give you nickels for the correct ones.

(Following this sequence the investigator said:)

You are getting to be pretty good with those "crazy" figures. Now we're going to try four sheets. Remember, please don't turn your sheets over until I say begin. Again, if you are real sharp you will see that three of the sheets are the same ones you used before. Let's see how many nickels you hard workers can earn this time. Please raise your hands when you are finished and I will let you know which "crazy" figures you have circled correctly. Are there any questions? Begin!

(Following this sequence, the investigator said:)

You certainly have fine memories. During the next several days, you will be playing this game with some other sheets like the ones you used today. You will have a chance to win many more nickels by trying to remember the correct figure for each sheet. However, sometimes when you are playing the game, I will not be able to tell you which ones you got right for several minutes or until some time later. Please remember that we will be playing games like these for the next ten school days.

First Day of Data Collection

(The children were exposed to the six conditions of this investigation within their self-contained special classes. Prior to the first session, the investigator said:)

Remember the games we played yesterday? Today, we are going to play six games using sheets of paper just like we did yesterday. When we played the first games yesterday, you sometimes had to guess which "crazy" figures were the correct ones. Again today, you will have to begin by guessing, but once you find out which figures are the correct ones, try to remember them. Please don't start or turn over your papers until I say begin. Remember to circle the figure on each sheet which you think is right. When you finish your game sheets raise your hand and I will come and pick up your papers.

Sometimes I will give your papers right back and tell you which ones you got right. Other times you will have to wait a bit or until after lunch to find out which ones you got correct.

Remember not everyone will be finished when you finish. I would really appreciate your being quiet until everyone is finished. Raise your hand when you are finished and I will pick up your game sheets. Are there any questions? Please begin!

(During each presentation, each child was timed. The presentation of each stimulus condition was randomized; therefore no one condition occurred predominately in the same position).

The Second, Third, Fourth, and Fifth Days of Data Collection

(The investigator said:)

We are going to play the same games today as we played yesterday. As you play each game try to remember which of the two "crazy" figures is the correct one. Look and listen carefully when I give you your nickels for the correct figures. Then, tomorrow you will not have to guess which ones are the correct ones. You will already know. In this way, you will earn a lot more nickels. The correct figures for each game are the same as yesterday.

Please don't turn over your papers until I say begin. Remember to raise your hand after you have circled your figures and I will come to your desk to pick up your sheets.

Please turn your sheets over and begin.

(Between response conditions, the investigator said:)

We are ready to play again. Look carefully at your sheets this time. Try to remember which figure is the correct one. In this way, you will not have to guess each time you play the games. You can earn a lot more money if you do not have to guess.

Ready, begin.

The Following Days of Data Collection

(The investigator said:)

We are going to play the same games today as we played yesterday. The correct figures for each game are the same as yesterday.

Please don't turn your papers over until I say begin. Remember to raise your hand after you have circled your figures and I will come to your desk to pick up your papers.

Please turn over your sheets and begin.

Response Conditions

Condition A

The investigator collected each child's papers within 10"-45", he informed the child which figures by number were correctly circled by handing the child the discriminative cue sheets and pointing to the appropriate figure while also dispensing the reward.

Condition B

The investigator collected each child's papers within 10"-45", he informed the child which figures by number were correctly circled while dispensing the reward.

Condition C

The investigator collected each child's papers and immediately following 15', he informed the child which figures by number were correctly circled by handing the child the discriminative cue sheets and pointing to the appropriate figure while also dispensing the reward.

Condition D

The investigator collected each child's papers and immediately following 15', he informed the child which figures by number were correctly circled while dispensing the reward.

Condition E

The investigator collected each child's papers and immediately following 3-hours, he informed the child which figures by number were correctly circled by handing the child the discriminative cue sheets and pointing to the appropriate figure while also dispensing the reward.

Condition F

The investigator collected each child's papers and immediately following 3-hours, he informed the child which figures by number were correctly circled while dispensing the reward.

APPENDIX D

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR EACH SUBJECT

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 1

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	14	7	12	12	23	103
	Number Correct	1	2	2	2	2	3
2	Response Time	20	12	20	12	10	9
	Number Correct	1	2	3	2	1	1
3	Response Time	10	154	28	10	11	15
	Number Correct	1	2	3	1	1	3
4	Response Time	52	14	72	53	36	39
	Number Correct	4	3	3	0	1	1
5	Response Time	59	28	43	32	22	105
	Number Correct	3	4	3	3	4	2
6	Response Time	46	151	25	39	30	37
	Number Correct	4	2	2	2	3	1
7	Response Time	63	40	15	7	29	12
	Number Correct	3	2	2	3	3	1
8	Response Time	30	6	13	8	23	47
	Number Correct	3	3	2	3	3	1
9	Response Time	25	10	24	10	8	18
	Number Correct	4	1	2	3	3	1
10	Response Time	26	8	15	15	40	21
	Number Correct	4	2	2	3	4	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 2

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	17	16	20	24	20	96
	Number Correct	1	3	4	2	1	1
2	Response Time	35	25	23	24	15	34
	Number Correct	1	3	4	2	1	1
3	Response Time	24	28	28	29	16	29
	Number Correct	1	1	3	2	4	1
4	Response Time	31	22	27	46	22	36
	Number Correct	2	1	1	1	4	3
5	Response Time	32	28	22	20	32	38
	Number Correct	2	0	0	3	2	4
6	Response Time	19	27	20	19	21	32
	Number Correct	2	1	2	3	2	4
7	Response Time	22	25	27	39	11	24
	Number Correct	3	3	1	1	2	2
8	Response Time	30	19	26	26	26	37
	Number Correct	2	0	3	0	1	1
9	Response Time	22	26	18	21	16	15
	Number Correct	0	2	2	2	1	1
10	Response Time	33	16	23	11	22	16
	Number Correct	2	3	2	2	1	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 3

Day		Conditions					
		A	B	C	D	E	F
1	Response Time	24	25	32	47	34	96
	Number Correct	3	1	3	3	3	1
2	Response Time	65	39	37	38	31	39
	Number Correct	3	1	3	3	2	1
3	Response Time	30	27	42	16	30	25
	Number Correct	4	3	4	2	3	1
4	Response Time	25	45	31	51	22	36
	Number Correct	4	4	4	2	3	1
5	Response Time	19	25	16	18	20	18
	Number Correct	3	4	3	2	2	2
6	Response Time	14	41	23	37	34	39
	Number Correct	3	3	4	2	2	0
7	Response Time	29	38	48	27	21	29
	Number Correct	2	2	3	2	2	1
8	Response Time	22	21	11	32	19	13
	Number Correct	2	3	4	1	2	1
9	Response Time	23	28	18	20	20	20
	Number Correct	2	3	4	1	1	1
10	Response Time	15	12	27	26	18	16
	Number Correct	2	3	4	2	2	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY
AND CONDITION FOR SUBJECT 4

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	14	13	19	35	15	90
	Number Correct	1	3	1	3	1	1
2	Response Time	30	11	23	20	21	18
	Number Correct	2	2	0	3	3	1
3	Response Time	13	13	16	17	15	10
	Number Correct	3	3	0	1	1	1
4	Response Time	15	12	31	14	11	11
	Number Correct	1	2	2	1	2	2
5	Response Time	10	8	8	7	8	15
	Number Correct	3	3	1	2	2	3
6	Response Time	38	8	10	12	8	10
	Number Correct	3	3	2	1	3	3
7	Response Time	13	18	11	13	10	11
	Number Correct	3	4	1	0	2	2
8	Response Time	19	15	19	13	33	11
	Number Correct	3	2	2	1	2	2
9	Response Time	20	28	12	19	13	15
	Number Correct	4	2	2	2	2	2
10	Response Time	20	31	26	24	12	11
	Number Correct	3	2	1	2	2	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 5

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	10	7	9	19	15	60
	Number Correct	1	3	1	3	2	3
2	Response Time	11	11	10	20	9	18
	Number Correct	1	3	1	2	4	3
3	Response Time	13	12	19	14	11	9
	Number Correct	1	2	2	2	4	4
4	Response Time	11	16	13	16	17	17
	Number Correct	1	3	2	2	1	1
5	Response Time	12	26	12	13	8	8
	Number Correct	3	1	3	2	3	2
6	Response Time	6	31	4	10	9	9
	Number Correct	2	2	1	3	1	1
7	Response Time	19	14	17	15	21	10
	Number Correct	3	3	1	3	1	1
8	Response Time	23	8	7	12	8	8
	Number Correct	3	1	3	1	3	2
9	Response Time	16	10	10	9	23	11
	Number Correct	3	1	1	3	3	2
10	Response Time	5	8	7	9	10	8
	Number Correct	2	2	0	2	2	2

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 6

Day		Conditions					
		A	B	C	D	E	F
1	Response Time	10	10	12	17	23	96
	Number Correct	2	2	3	2	1	1
2	Response Time	113	37	140	35	18	18
	Number Correct	0	3	1	2	3	1
3	Response Time	43	22	95	31	22	18
	Number Correct	2	2	3	2	3	1
4	Response Time	31	20	21	29	23	37
	Number Correct	3	2	2	2	3	2
5	Response Time	22	26	19	8	13	12
	Number Correct	4	1	2	2	1	2
6	Response Time	8	17	17	10	26	35
	Number Correct	4	2	3	2	1	2
7	Response Time	36	27	10	22	9	20
	Number Correct	4	1	2	2	1	2
8	Response Time	8	13	12	34	8	10
	Number Correct	3	2	3	2	1	2
9	Response Time	25	30	20	18	30	18
	Number Correct	4	2	2	2	1	2
10	Response Time	8	8	6	11	15	17
	Number Correct	4	2	2	2	1	2

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 7

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	18	15	12	20	14	38
	Number Correct	2	3	2	1	3	3
2	Response Time	33	17	23	45	19	15
	Number Correct	3	1	2	1	3	3
3	Response Time	11	16	22	10	20	12
	Number Correct	2	1	1	1	3	4
4	Response Time	18	12	11	11	12	17
	Number Correct	2	3	1	2	4	4
5	Response Time	17	16	8	11	11	8
	Number Correct	2	1	3	1	2	2
6	Response Time	9	12	9	7	23	23
	Number Correct	2	1	3	0	4	3
7	Response Time	18	26	42	51	18	9
	Number Correct	2	2	2	1	4	2
8	Response Time	12	12	11	12	14	10
	Number Correct	2	2	2	4	0	3
9	Response Time	10	10	14	37	17	8
	Number Correct	2	3	2	1	3	4
10	Response Time	29	24	22	20	24	9
	Number Correct	2	2	3	3	0	2

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 8

Day		Conditions					
		A	B	C	D	E	F
1	Response Time	14	12	22	13	93	48
	Number Correct	1	0	2	2	3	1
2	Response Time	38	12	55	15	33	9
	Number Correct	1	2	0	2	3	1
3	Response Time	47	91	50	40	24	25
	Number Correct	3	2	3	2	1	3
4	Response Time	43	9	5	49	38	42
	Number Correct	3	1	3	2	2	2
5	Response Time	26	14	27	37	39	7
	Number Correct	3	0	2	1	1	1
6	Response Time	20	21	32	23	19	153
	Number Correct	4	2	2	2	1	2
7	Response Time	115	19	22	29	30	9
	Number Correct	4	1	2	2	1	1
8	Response Time	30	25	46	20	33	32
	Number Correct	2	1	3	2	2	0
9	Response Time	8	9	5	7	12	9
	Number Correct	3	1	4	1	2	1
10	Response Time	9	10	9	7	11	55
	Number Correct	3	0	3	2	2	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY
AND CONDITION FOR SUBJECT 9

Day		Conditions					
		A	B	C	D	E	F
1	Response Time	24	24	37	11	17	24
	Number Correct	3	2	3	2	1	2
2	Response Time	35	24	18	15	42	25
	Number Correct	1	2	3	2	3	1
3	Response Time	20	37	20	16	20	20
	Number Correct	1	2	2	2	2	1
4	Response Time	18	39	11	22	16	27
	Number Correct	1	3	3	3	4	1
5	Response Time	24	25	22	24	19	34
	Number Correct	2	2	4	3	4	1
6	Response Time	23	8	29	22	12	25
	Number Correct	1	1	2	2	4	2
7	Response Time	7	18	9	14	20	22
	Number Correct	3	1	3	1	4	2
8	Response Time	9	10	17	17	25	20
	Number Correct	1	1	4	2	4	2
9	Response Time	19	17	15	29	12	7
	Number Correct	2	3	4	2	4	2
10	Response Time	10	24	22	17	20	32
	Number Correct	1	1	4	2	4	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 10

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	60	16	61	16	16	21
	Number Correct	0	2	3	3	1	1
2	Response Time	19	20	16	27	24	28
	Number Correct	1	2	3	3	2	1
3	Response Time	95	70	93	60	55	68
	Number Correct	1	2	4	3	1	1
4	Response Time	32	45	17	35	48	44
	Number Correct	1	1	3	2	2	2
5	Response Time	33	127	29	43	27	103
	Number Correct	1	2	3	3	1	1
6	Response Time	133	28	15	15	20	28
	Number Correct	1	2	4	3	1	1
7	Response Time	60	19	30	9	24	13
	Number Correct	1	2	4	3	1	2
8	Response Time	22	17	29	17	35	33
	Number Correct	1	2	4	2	2	2
9	Response Time	14	14	55	41	22	24
	Number Correct	1	2	3	3	1	2
10	Response Time	7	18	12	20	24	26
	Number Correct	1	1	3	3	1	1

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY
AND CONDITION FOR SUBJECT 11

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	43	45	28	15	19	36
	Number Correct	0	1	2	0	0	0
2	Response Time	29	36	30	23	22	37
	Number Correct	2	1	2	0	1	2
3	Response Time	37	40	42	16	11	22
	Number Correct	3	3	4	1	2	3
4	Response Time	51	32	17	39	25	22
	Number Correct	3	2	2	3	2	4
5	Response Time	43	19	25	20	40	7
	Number Correct	2	2	2	1	2	3
6	Response Time	16	122	15	13	21	30
	Number Correct	4	1	1	2	1	2
7	Response Time	26	11	14	12	20	7
	Number Correct	2	1	0	1	1	4
8	Response Time	7	15	9	12	9	16
	Number Correct	1	1	1	2	2	3
9	Response Time	14	7	46	12	7	20
	Number Correct	3	0	1	1	1	3
10	Response Time	12	19	25	27	29	49
	Number Correct	3	2	4	2	2	2

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 12

Day		Conditions					
		A	B	C	D	E	F
1	Response Time	8	10	9	10	10	27
	Number Correct	2	3	4	2	2	2
2	Response Time	17	11	13	51	9	21
	Number Correct	1	1	2	1	3	3
3	Response Time	12	14	23	8	12	16
	Number Correct	3	2	2	1	2	1
4	Response Time	13	11	11	13	11	22
	Number Correct	2	1	1	1	2	0
5	Response Time	19	16	22	9	14	23
	Number Correct	2	2	0	2	3	1
6	Response Time	15	11	19	16	15	24
	Number Correct	3	1	2	2	3	2
7	Response Time	18	11	14	12	11	26
	Number Correct	3	3	2	2	4	3
8	Response Time	14	10	27	12	15	16
	Number Correct	1	2	3	1	3	3
9	Response Time	29	18	17	14	20	20
	Number Correct	0	3	2	0	3	2
10	Response Time	13	12	17	18	20	13
	Number Correct	2	2	3	1	1	3

RESPONSE TIME AND NUMBER CORRECT REPORTED BY DAY AND CONDITION FOR SUBJECT 13

		Conditions					
Day		A	B	C	D	E	F
1	Response Time	13	9	15	27	18	45
	Number Correct	4	1	2	1	3	2
2	Response Time	19	13	12	15	11	11
	Number Correct	3	1	2	2	1	1
3	Response Time	17	10	14	7	13	14
	Number Correct	3	1	2	3	1	1
4	Response Time	12	13	6	17	16	19
	Number Correct	2	1	2	3	2	2
5	Response Time	20	9	7	11	7	23
	Number Correct	3	1	2	4	2	1
6	Response Time	13	31	35	8	25	29
	Number Correct	4	1	3	1	1	2
7	Response Time	15	9	42	8	10	22
	Number Correct	3	1	3	3	3	3
8	Response Time	10	22	18	9	15	13
	Number Correct	3	1	4	3	3	3
9	Response Time	30	15	15	17	15	16
	Number Correct	4	1	3	2	4	3
10	Response Time	23	20	25	20	13	26
	Number Correct	4	1	3	3	4	3

APPENDIX E

CELERATION COEFFICIENTS OF CORRECT RESPONDING REPORTED BY CONDITION FOR EACH SUBJECT

CELERATION COEFFICIENTS OF CORRECT RESPONDING REPORTED BY CONDITION FOR EACH SUBJECT

	Conditions					
Subjects	A	B	C	D	E	F
1	1.533	1.177	0.984	1.660	1.496	0.741
2	1.060	0.903	0.805	1.044	0.779	3.123
3	1.022	2.344	1.419	0.808	0.974	31.867
4	1.396	0.722	2.794	0.839	1.207	2.279
5	1.628	0.799	1.164	1.238	0.891	1.310
6	2.563	1.035	3.057	1.239	0.797	5.110
7	1.030	1.051	1.152	1.372	0.531	1.289
8	2.899	0.986	2.732	1.415	2.573	0.682
9	1.659	1.043	1.344	1.207	1.677	1.543
10	-2.900	1.346	1.326	1.140	0.925	16.667
11	4.632	3.319	1.157	5.583	2.138	1.590
12	0.690	1.074	0.884	0.727	0.780	1.857
13	0.960	0.724	0.941	1.248	1.486	1.837

APPENDIX F

CELERATION COEFFICIENTS OF INCORRECT RESPONDING REPORTED BY CONDITION FOR EACH SUBJECT

CELERATION COEFFICIENTS OF INCORRECT RESPONDING REPORTED BY CONDITION FOR EACH SUBJECT

	Conditions					
Subjects	A	B	C	D	E	F
1	0.153	1.590	1.870	0.743	1.567	2.355
2	1.177	1.113	4.104	1.444	1.600	3.137
3	10.505	1.145	1.698	2.732	2.815	2.013
4	0.481	1.251	1.065	1.473	1.004	1.404
5	0.712	1.483	1.164	1.402	1.870	6.187
6	1.690	1.324	5.423	1.239	1.832	1.316
7	1.236	1.051	0.780	0.607	1.823	3.402
8	1.048	1.251	0.720	1.638	6.636	1.180
9	1.764	1.583	1.556	1.075	1.900	1.107
10	2.039	1.616	1.139	1.430	1.094	1.084
11	1.942	2.800	1.158	1.051	1.636	1.268
12	1.095	0.873	1.071	1.111	0.636	0.882
13	1.325	0.826	0.427	1.090	0.449	1.367

APPENDIX G

CELERATION RATIOS REPORTED BY CONDITION FOR EACH SUBJECT

CELERATION RATIOS REPORTED BY CONDITION FOR EACH SUBJECT

	Conditions					
Subjects	A	B	C	D	E	F
1	1.380	-0.413	-0.885	0.917	-0.071	-1.613
2	-0.117	-0.210	-3.298	-3.399	-0.821	-0.014
3	-9.483	1.199	-0.280	-1.924	-1.841	29.854
4	0.915	-0.529	1.728	-0.634	0.203	0.875
5	0.916	-0.684	0.000	-0.163	-0.980	-4.877
6	0.873	-0.289	-2.366	0.000	-1.036	3.794
7	-0.206	0.000	0.372	0.765	-1.292	-2.113
8	1.851	-0.265	2.012	-0.223	-4.063	-0.498
9	-0.105	-0.539	-0.211	0.131	-0.223	0.436
10	-4.938	-0.270	0.186	-0.291	-0.169	15.584
11	2.689	0.520	-0.001	4.532	0.501	0.322
12	-0.405	0.201	-0.187	-0.385	0.144	0.974
13	-0.365	-0.102	0.514	0.159	1.037	0.470

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BIOGRAPHICAL SKETCH

M. Winston Egan was born in Salt Lake City, Utah. He graduated from Olympus High School in Salt Lake City. Following his secondary education, he attended the University of Utah briefly after which he filled a mission for the Church of Jesus Christ of Latter Day Saints. Later, he attended Brigham Young University in Provo, Utah graduating with a Bachelor of Arts degree in elementary education and a minor in German.

Following his undergraduate studies, he served an internship at the Exemplary Center for Reading Instruction, taught sixth grade for three years, and was a teacher of children and youth with behavior/learning problems at Utah Boys' Ranch, all in the Salt Lake City area.

Later, he was an E.P.D.A. fellowship recipient in the Early Childhood Project at Oakland University, Rochester, Michigan and graduated with a Master of Arts of Teaching in early childhood education.

In the fall of 1972, he was appointed as a doctoral fellow in the Department of Special Education in the area of the emotionally disturbed at the University of Florida during which time his experiences included a teaching internship at the college level, an administrative internship in the Hillsborough County Public School System, Tampa, Florida, and a directorship of a private tutoring program. In addition he was intricately involved in the development of a competency based training program at the master's level, and served as a co-director of a summer demonstration laboratory school designed for children with behavior/learning problems.

He is married to the former Linda Lee Mangum and has four delightful children, Daniel, Amy Dott, Mary Ann, and Marcia Mae.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Lyndal M Bullock

Lyndal M. Bullock, Chairman
Associate Professor of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William R. Reid

William R. Reid
Professor of Education

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Myron Cunningham

Myron Cunningham
Professor of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

(For A.B. Packer)

A. B. Packer
Associate Professor of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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